CHAPTER 3

Automated Track Inspection Program

INTRODUCTION

The purpose of this chapter is to provide guidance and understanding of the on-track safety requirements, operation and national deployment of the Automated Track Inspection Program (ATIP), track geometry inspection cars. ATIP serves an important role in the FRA's overall compliance programs. The primary safety-related use of ATIP is the assistance provided to FRA inspectors in identifying the most important track locations and conditions. Through the precise measurement of existing track systems, analysis approaches and procedures, data produced by the geometry car provides a visible representation of the status of the railroad's inspection and maintenance program, and supports FRA inspectors in objectively determining compliance with the *Track Safety Standards* (TSS).

FRA relies on ATIP onboard measurement and geographic reference data systems as a primary and valuable tool for safety inspectors to:

1. Assess a railroad's performance-based compliance with TSS, defect exception analyses, and convenient access to historical data for a particular-surveyed railroad;

2. Evaluate the effect of proposed changes in the TSS;

3. Provide an early indicator of the safety trends within the industry;

4. Support special safety studies, including accident/incident investigations, congressional, and public requests through archiving in a centralized data management system;

5. Set priorities for enforcement activities, compliance agreements, perform quality assurance checks for the geometry car;

6. Inventory track structures (e.g., turnouts, at grade railroad crossings, highway-rail crossing's locations *etc*.), and track geometry details (e.g., curve locations, amount of elevation, etc.); and

7. Provide a quality and beneficial customer service to the public and the railroad industry, assuring a safe environment and a positive contribution to the economy.

The key to ATIP's safety success is the detection of potential accident-causing hazards. In the last few years, changes in the railroad industry (e.g., mergers, heavier equipment and traffic patterns on some routes reaching maximum track capacities) have occurred,

which bring about the importance and ability to inspect track faster, with more accuracy, while not interfering with railroad operations. To meet these needs, FRA geometry cars incorporate instrumentation that generates an efficient, quantitative statement of known track conditions, affording a cost-effective means of expanding national inspection coverage.

FRA geometry cars (e.g., FRA T-10 and FRA T-2000) are railbound self-propelled diesel automated track inspection vehicles, which measure track geometry (i.e., gage, track alinement, and surface) for compliance with the TSS. February 2001 marked the inaugural deployment of FRA's newest geometry car, FRA T-2000. The T-2000 replaced its predecessor T-10, after nearly twenty years and some half-million miles of service as the most advanced geometry car of its kind. T-2000 exemplifies state-of-the-art track geometry equipment and technology for both the vehicle and onboard measurement systems, including innovations in the measurement of ride quality using accelerometers. This consists of such advances as full crashworthiness protection, high-speed trucks, optical laser measuring system, and Differential Global Position System (DGPS) for precise location of track defects and other points of reference.

POLICY

Safety onboard an FRA geometry car is of the utmost importance. Safe ATIP operations are the responsibility of FRA and ATIP contractor personnel, and as such, they are held accountable for the control, authority and enforcement of this policy. Inspectors assigned to geometry cars are to ensure applicable compliance with railroad operating rules, special instructions, and specific policy procedures by all onboard personnel when geometry cars are either operated in the self-propelled mode or coupled to and towed by a locomotive.

The geometry car is designed and constructed to operate safely, in accordance with railroad rules and federal regulations. Thus, the geometry car is equipped with drawbars and couplers, high-speed trucks, airbrake reservoir and apparatus, a dead-engine feature to permit locomotive towing, and the required markers and forward/reverse illumination. Accordingly, it is FRA policy that the geometry vehicle is defined as, "specialized maintenance equipment," maintained and operated by a contractor.

An FRA geometry car is not considered a locomotive[1] when self-propelled. FRA elects that the geometry car will function, in accordance with and protected by applicable railroad operating rules (e.g., GCOR, NORAC or other operating rules) and the car will be operated as a train[2]. The FRA geometry car Operator will operate at the direction and guidance of a qualified Locomotive Engineer/Pilot and as such will not be regarded as a "Locomotive Engineer/Pilot" under qualification and certification of locomotive engineer regulations.

Inspectors are requested to report to FRA Track Division staff any situations that do not conform to the following procedures and instructions.

[1] 49 CFR Part 229 Subpart A - General §229.5 (k) Definitions

[2] 49 CFR Part 236 Subpart G - Definitions §236.832 - Train

FRA T-2000 is significantly different from T-10 in design and instrument sensitivity. FRA policy, when the geometry car is operating or stopped and the risks of accidental spills are likely, that no food or drink is permitted in certain designated (electronic and sensitive equipment) areas in either the controlling compartment or rear observation areas. Purchase and storage of sufficient cold food and soft drink, disposable plates and utensils, required for a meal, is available to all personnel onboard the geometry car. The intent is to avoid stopping the ATIP survey and altering the schedule. Operating delays provide an opportunity to relax in the galley from the assignment demands and provide the occasion where one can have an unhurried meal. Even so, signs are in place as a reminder, and it is expected that everyone act responsibly.

If any railroad, FRA, State, or contractor personnel decides not to eat available food supplied on-board the car, under no circumstances should the car be stopped for a meal, except where a health or fatigue concern is imminent and verifiable by the Operating Practices (OP) inspector and concurred by the Survey Director. Occupants should bring a "sack lunch" onboard if they elect not to accept a meal provided on the car.

In order to expedite the completion of the day's survey, occupants of the car should take meals in conjunction with survey delays, preferably between 1000 hours and 1400 hours and/or from 1600 hrs to 2000 hours.

SAFETY ON-BOARD AND ON-TRACK

Job Briefing:

The Survey Director's duty is to provide a job briefing on general safety apparatus and on-track protective procedures, whenever anyone leaves the geometry car and fouls a track. Safety on board FRA ATIP's geometry car is of utmost importance. The job briefing shall discuss the following:

1. Applicable operating hazards and procedures when fouling the track;

2. Hazards onboard the car;

3. Location of geometry car safety apparatus, such as fire extinguishers, first aid kits, and those onboard trained in CPR; and

4. Procedures for egress through specific doorways and windows, and general communication methods during emergencies,

If additional persons come onboard during the course of the survey day it will be the responsibility of both the FRA Track and OP inspectors to directly work with the Survey Director to ensure all occupants are briefed and updated, as safety conditions or events unfold, onboard the geometry car.

Fouling the Track:

If it becomes necessary for anyone to foul a track, the most appropriate course of action is to ensure safety and communicate with a competent person representing the host railroad. In the absence of a railroad representative, the Survey Director will become the person responsible for establishing on-track safety. Either individual shall establish on-track safety by utilizing the geometry car's exclusive authority to move on controlled track (train coordination). All T-2000 movements shall be coordinated with the Survey Director.

Occasionally, the FRA Track inspector or the railroad-engineering representatives may request that the ATIP geometry car stop in order for personnel to walk the track and observe a track condition. When evaluations are performed on the track after stopping the geometry car, railroad employees are expected to perform the following:

1. Railroad employees must conduct activities on the track in accordance with appropriate on-track safety provisions.

2. When a railroad employee accompanies FRA or State inspectors, the inspector and the railroad employee will be considered a 'roadway work group'. It will be necessary that the railroad employee be designated by the railroad to provide on-track safety for the work group. The FRA or State inspector will request a job briefing from the railroad employee before fouling the track.

3. The railroad employee-in-charge is reminded that protection may be afforded by train coordination, as previously discussed, in coordination with the Survey Director, and inquire as to the nature of the protection such as train approach warning on adjacent tracks, if it is the intention of any member of the group to foul the adjacent track.

It is unlikely that a railroad employee would be unable or decline to assume the role of the employee-in-charge. However, in such a circumstance, the FRA Track inspector may deem it necessary to inspect the track behind the ATIP geometry car and on-track safety may be derived in accordance with FRA policy as follows:

1. Two FRA or State inspectors may work together, with one acting as a watchman/lookout for the other, provided they know the operating characteristics of the railroad at that point, including train speeds.

2. An FRA or State inspector working alone is authorized by themselves to obtain the safety awareness of a briefing by ascertaining the operating conditions of the railroad at that inspection point. It will be the individual inspector's responsibility to develop the information necessary to provide a full level of on-track safety.

3. When evaluating track in connection with an ATIP survey on controlled track, the inspector may establish train coordination with the ATIP geometry car (train). On

non controlled track, inaccessible track or train approach warning (watchman lookout) procedures must be used.

4. The FRA or the railroad may invite guests on the car. In any case, guests are not authorized to be on the track without the permission and protection afforded by the railroad. The term “guests” does not include ATIP contractors who may perform duties on or near the track under the policy described in this chapter.

Securement of Car:

Track inspectors will ensure compliance with the provisions of Attachment A, Item 14, which is contained in this chapter, describing the protection afforded to anyone when the geometry car is in a locomotive servicing area or located within inaccessible track (a method of establishing working limits on non-controlled track by physically preventing entry and movement of trains and equipment).

To prevent undesired access when the geometry car is unoccupied, the ATIP contractor will always provide protective measures. Conditions may exist that will **not** allow full protective devices to be applied. The track inspector will notify RRS Track Division staff whenever such a condition occurs.

Track inspectors are responsible for proper securement, as outlined in Attachment A, Item 15, and will use good judgment and discretion in the application and placement of protective devices, and ‘train control signs’ (e.g., red flags) as circumstance warrant.

DUTIES OF FRA INSPECTORS AND CONTRACTOR

The primary purpose of this assignment activity is to assure the geometry car is operated safely, in accordance with FRA policy, railroad operating rules, and that individual railroad track is being maintained, inspected, and complies with the TSS:

1. All assigned personnel will report to FRA T-2000 promptly at the designated time to avoid a delayed departure.

2. Each of FRA’s eight regions will be represented by a Track and OP inspector, onboard the geometry car when in active survey status. Normally, the planned survey route is the assigned duty location and responsibility of the inspectors.

3. The senior onboard FRA Track inspector will be the final decision-making authority on the proper course of action for planning and overall supervision of ATIP surveys. The senior onboard OP inspector will be the final decision-making authority on the proper course of action for the safe operation of the car.

FRA Track Inspectors:

FRA Track inspectors are responsible for monitoring and assessing thousands of railroad track miles. ATIP assists the inspectors in meeting this responsibility and in so doing, requires the inspector to interpret, and verify first-hand, the data collected and for relating TSS exceptions to the surveyed track. The FRA Track inspector is required to ride the geometry car to permit real-time interpretation of analog, video and printed outputs. This allows the Track inspector to:

1. Immediately discuss questionable track geometry exceptions with the onboard railroad representatives;

2. Conduct manual on-the-ground inspections to verify measurable inputs;

3. Insure proper and immediate remedial action is taken to halt or slow train operations on any portion of track containing a severe safety problem; and,

4. Observe track and right-of-way conditions (e.g., vegetation obstructing visibility of signals and at highway-rail crossings) and detect TSS exceptions not measured by the geometry car measurement system.

FRA OP Inspectors:

Enclosure A, Items 3 and 4, mainly describes the expected duties of the OP inspector, namely:

1. Everywhere the ATIP geometry car (in self-propelled status) is operated, it is to be recognized by the railroad and function singularly as a 'train' in either signal or non-signal system designated territories under the requirements contained herein and the respective Operating Practice compliance manual;

2. Lineup movement of track cars or similar "authorities" are prohibited;

3. The geometry car is operated within absolute blocks on main tracks and no one will receive authority within the same or overlapping limits, except to aid the geometry car, if it should become disabled;

4. Responsible alternative FRA T-2000 protection methods, controls or authority may be applied against following or opposing train and on-track equipment, at the discretion of the Locomotive Engineer/Pilot and the Survey Director. See Attachment A of this Chapter, Item 3.

Highway-Rail Grade Crossings:

All occupants in the controlling compartment of the geometry car are responsible for ensuring the way is clear when approaching highway-rail grade crossings equipped with either passive or automatic warning signal system devices as detailed below:

1. The rate of deceleration must be controlled to that deemed appropriate, based on the local conditions (e.g., gradient, visibility, individual rail surface stopping conditions), etc.;

2. Occupants must be aware of crossing in advance and be prepared to stop until it is determined the grade crossing automatic warning devices have fully activated;

3. If signal system failures disrupt the proper function of the warning devices, the occupants must be immediately able to respond;

4. The railroad representative will report warning system malfunctions to the Dispatcher according to 49 CFR Part 234; and

5. Occupant must take precautions to not interfere with the normal function of the automatic warning signal system devices, except on condition that proper flag protection against highway vehicles is provided by the contractor or railroad when automatic warning devices fail to fully activate or when required by the host railroad rules, Part VI of the FHA MUTCD[3] provisions, or FRA regulations.

Contractor Duties:

On behalf of the FRA, the contractor employees are to operate and maintain the government-furnished geometry car safely and efficiently, accurately record track geometry data, perform corrective and preventive maintenance work, make the necessary adjustments, and perform all activities required to keep the geometry car's equipment and instrumentation in an operational, safe, clean and orderly condition.

[3] Federal Highway Adminnistration, Manual on Uniform Traffic Control Devices

GENERAL PROCEDURES

Safe Operation:

Inspectors and ATIP contractor employees must conduct activities in accordance with the specific instructions related to RWP contained in the *Workplace Safety Compliance Manual* and the above instructions contained in this chapter. **Safe operation of the geometry cars will not be compromised and all instructions (see Attachment A) will be complied with.** The following general procedures outline FRA policy governing the geometry car's safe operation:

Delays:

The Track inspector (in conjunction with the Contractor) will be responsible for reporting recurring or prolonged delays, and ascertaining the reason for these delays and/or operating constraints (e.g., hours-of-service restriction's affecting personnel, dispatching and crew delays, etc.) being placed on the ATIP operations by the railroad. For this purpose, the use of the onboard telephone to advise FRA Track Division staff, and regional supervisors is authorized and will be made at the earliest practical time, should any unusual event occur significantly affecting ATIP schedules or operational capabilities.

Use of Tow Locomotive:

The Track inspector (in agreement with the Survey Director) is authorized to request a tow locomotive and crew if one or more of the following occurs:

1. The propulsion system fails and/or the braking capabilities are affected; or

2. The geometry car is normally self-propelled and independently operated, unless the railroad's operating rules require onboard automatic cab signal, automatic train stop, or automatic train control systems. Consequently, the geometry car does not have these features and must be towed by a railroad-owned locomotive, in accordance with railroad signal rules, or the maximum authorized track speed, whichever is lower; or

3. In all other cases, RRS Track Division staff will authorize, in advance, the lease of a single-unit locomotive, the use of essential railroad crewmembers, and the reimbursement of the lease cost service to the railroad.

Testing Sidings:

Track inspectors are advised to test applicable controlled sidings and 'other than main tracks' at their discretion and when the opportunity is feasible. For example, going into a siding to meet other trains would present an occasion to test for compliance.

General Instructions:

FRA inspectors are not to be directly involved with the movement of FRA T-2000 insofar as operating the controls, talking over the radio, or adjusting/operating any survey computers or equipment. During geometry car operation, FRA inspectors are to limit conversation with the Locomotive Engineer/Pilot and geometry car Operator to matters regarding the safe movement of the vehicle.

Changing Operating Ends:

Geometry car movement in either forward or reverse direction, to accomplish on-the-ground verifications of track defects being measured or for other purposes, will be accomplished in accordance with the railroads operating rules. Conditions that require changing controlling ends of the vehicle include, but are not limited to:

1. Operations through a interlocking,

2. Operations over multiple highway-rail crossings, or

3. Operations of a significant distance, (usually two miles or more).

Preparation:

The geometry car's onboard Track Geometry Measurement System (TGMS) instrumentation generates automated analog signals, which are processed on-line by a computer and sustain a graphical record of detailed track geometry conditions, including delimiting measurements. The geometry car may discharge these tasks at speeds from five (5) up to 110 mph, but normally operates in a 20 to 60 mph speed range. The measured geometry parameters are compared to preset values to evaluate compliance to predefined standards. Points on the track that exceeds these preset values are listed as an exception, until field verified as defects. Pinpointing these exceptions can be facilitated by paint or DGPS marking.

The geometry car measures and accurately records exceptions from the TSS geometry parameters for the lower speeds (Class 1-5), as well as exceptions to the requirements for track with speeds up to 200 mph (Class 6-9) contained in 49 CFR Part 213, Subparts A through F, and G, respectively.

Operating Limitations on Curves:

Although the geometry cars comply with select AAR interchange rules, curves greater than 13-degrees, but not exceeding 20-degrees, may present other clearance issues and govern or restrict operation. Operation of the T-2000 through curves sharper than 20 degrees is prohibited.

Prior to operating through areas of changing curvature, the ATIP contractor must be notified where the plotted degree of curve exceeds the current settings of 5, 10, or 15-degrees. For example, if the selected current settings of a curve are different from those established in the track chart, the Contractor personnel will be notified immediately,

Class of Track:

ATIP Contractor employees will assist both the FRA OP and Track inspectors in the monitoring of authorized speed accuracy according to reported track classification, and will verify the geometry car speed indicator accuracy (timed checks) at suitable locations against all authorized timetable, general order, and track bulletin information submitted by the railroad as it applies to current track classification and related assigned speed values of authorized train movement.

To improve the accuracy of track classification, the Contractor confirms the correct speed information by the: (1) receipt of information in the speed chart provided by the Track Safety Inspector, (2) confirmation of the correct speeds through initial discussion and updates from the railroad engineer/pilot, and (3) observation of speed signage along the right-of-way.

Correctly entered timetable speed is important because the onboard computer always registers the highest class and is independent of other speed restrictions. Specific track geometry safety limits, corresponding to the assigned class, are used to generate a list of exceptions. Routinely, temporary speed orders (TSO's) are not entered. FRA inspectors typically confirm and amend the TSO's from the exception list report during follow-up inspections with the railroad.

The FRA or State Track Inspector will coordinate with the ATIP Contractor prior to the survey, current track number(s), an up-to-date authorized timetable passenger and freight train speeds (speed chart, preferably electronic), and track charts (curvature) input information for the daily period of the survey. Verifiable General Order and Track Bulletins, that reduce the operating speed of trains, may be edited from the geometry report exception list, but may not be substituted as the maximum authorized train speed. The geometry car will always test and record at the higher track classification, in accordance with a current timetable or special instructions regarding the type of equipment operated (i.e., passenger or freight). For example, freight train speed is 70-mph and a General Order reduces freight speed to 60-mph, the geometry car will test, record, then edit out applicable Class 5 geometry parameter exceptions from the exception list report, but will record noncomplying Class 4 or lower geometry exceptions, governed by the General Order. Edited exception locations and values are not deleted from electronic storage and are available for subsequent analysis (e.g., if the railroad raises the speed).

For the purpose of ATIP surveys, tracks 1-4 are standard notations for double or multiple controlled track locations, unless otherwise numbered by the carrier. Track 5 is designated as a single track, where single track exists. Track 6 is designated for a controlled siding and

Track 7 notations, will usually represent Excepted Track and all other than main non-controlled track.

Inspectors will not test the track at a higher than the authorized or 'posted' class of track contained in a current timetable. If a railroad requests this type of track quality analysis, the request should be forwarded to the Office of Safety, Track Division. As resources are available, the request will be processed and forwarded to the railroad.

Malfunction of Data Equipment:

In cooperation with the ATIP contractor, inspectors will monitor the analog strip (brush) chart parameters and verify, on a recurring basis, that all channels are within scale and reading properly, and convey this information to railroad maintenance-of-way representatives, ensuring a complete understanding of the data presented. Any condition that warrants questionable parameter information is cause for stopping the survey and determining the source of the problem. A single-point failure of any parameter is justification to stop the survey at that location, until repaired. If repairs cannot be made to gage and crosslevel parameter failures, the survey is not to be continued.

Maximum Speed on Curve:

The V_{max} formula considers the variables of elevation, curvature, and the amount of unbalanced elevation or cant deficiency in determining the maximum curving speed. Curving forces becomes more critical, if variations in track, vehicle characteristics, or improper train handling conditions have not been abated. Inspectors must determine compliance with the surface standard in §213.63 or the alinement standard in §213.55, which in some cases may be more restrictive. The maximum speed on a curve is determined by averaging both the alinement and crosslevel measurements for ten-points (11 stations) at 15½-foot spacing. A curve's elevation and amount of curvature for each 155-foot track segment is calculated by the geometry car and produces a limiting speed, using the V_{max} formula. Speeds on curves calculated by geometry car measurements of superelevation and curvature is to be strictly enforced in accordance with the instructions in Chapter 5.

Adjustment of Gage Measuring Point:

Certain rail sections (headfree rail) and special trackwork are designed where the ⅝-point on the gage side of the rail is difficult to measure automatically. Significant lengths of this type of track condition may warrant an adjustment to the gage sensor by Survey Director, and only when authorized by RSS Track Division staff. Extreme vertical headwear loss also presents problems associated with proper measurement. This rail specialty condition may influence the accuracy of the test and will be identified on the exception report. Inspectors are advised to discuss the plans to remedy the rail condition with the railroad.

Stopping the Car for Verification:

A railroad representative may question the contractor regarding the accuracy of a reported defect on the geometry car. In those cases, the Track Inspector may stop the car and substantiate the defect by conducting instrument verifications and/or direct track measurements, supervised under proper on-track safety procedures.

REPORTS

Track Inspection Reports, Form F 6180.96, will be prepared for each operation of an ATIP survey with appropriate source codes and the survey number. See Chapter 2 of this manual for instructions on preparing the track inspection report form. To avoid duplication, only one Form F 6180.96 will be completed for each segment of the survey, even though more than one Inspector may be onboard.

I **ATIP SURVEY** Use this source code with an Office of Safety assigned ATIP survey file number, e.g., CSXT_0126. This code will be used when inspecting track during ATIP active status surveys. Only the report header of the form is to be filled out during these inspection activities. **DO NOT RECORD SURVEY DEFECTS ON THE 96 FORMS.** Enter only the number of miles of track inspected under the (activity code) unit's box. This is to correspond with the daily number of miles operated by the ATIP geometry car either self-propelled or towed by a locomotive during an ATIP active status survey.

J **ATIP FOLLOW-UP** Use ATIP number corresponding to the original survey files number, (e.g., CSXT_0126) assigned by the Office of Safety. On-the-ground field verification of reported noncompliance conditions will normally take place within 60-days following the survey. If field verification procedures are instituted while the ATIP vehicle is in survey status and noncompliance conditions are to be cited, the inspector must initiate a report separate from the one required under ATIP SURVEY. Under no circumstances will data generated by the ATIP vehicle be used to cite defects from the standards without the inspector first verifying their existence through field verification procedures.

N **ATIP INSPECTION OF STRACNET** (Strategic Railway Network) an assigned military route, important to the National defense.

End of Chapter Three

COMPLIANCE MANUAL ATTACHMENT A
SELF-PROPELLED TRACK GEOMETRY INSPECTION CAR (15) INSTRUCTIONS

Federal Railroad Administration (FRA), Office of Safety manages a railbound high-speed track geometry inspection car (identified as either FRA T-2000 or FRA T-10) to measure track geometry for compliance with the Federal Track Safety Standards nationwide.

1. Each Train Dispatcher and Locomotive Engineer/Pilot will be furnished with a copy of this enclosure.

2. Prior to each day's survey, the contractor will conduct a face-to-face safety briefing to all occupants of the GEOMETRY CAR and review applicable operational and safety conditions or on-track protection procedures. Proper equipment is onboard for signaling.

3. FRA inspectors, prior to the survey operation, will communicate directly with the train dispatcher and Locomotive Engineer/Pilot, to insure that all operating rules, in effect on the route to be traveled, are understood and confirm the GEOMETRY CAR will be dispatched as a train. Reference to applicable operating documents (Timetable, Special Instruction, General Order, Track Bulletin or similar documents) will confirm dispatching and operational information. FRA inspectors will be stationed in the immediate vicinity where the method of operation, procedures, and movement allows monitoring.

4. Whenever the GEOMETRY CAR is operated, the railroad will assign and provide a Locomotive Engineer/Pilot, Traveling Engineer, or Road Foreman. The GEOMETRY CAR operator solely relies on the Locomotive Engineer/Pilot to identify relevant railroad physical characteristics, movement authority limits and authorized speeds, a sufficient distance in advance. GEOMETRY CARS are governed by applicable operating rules when moving on either signal or non-signal system territories (except that auto routing and automatic clearing features will not be used and all dual control switches will be blocked). Absolute block protection or alternate protection methods, controls or authority (except within "yard or restricted" limit territory require all trains operate at Restricted Speed), will be applied to protect GEOMETRY CARS against opposing and following trains or on-track equipment.

5. GEOMETRY CARS operate as a train. Authorization will not be issued within the same or overlapping limits of another train or on-track equipment, except to facilitate a disabled movement or emergency. Restricted Speed will govern movement within these limits according to the railroad's operating rules. FRA GEOMETRY CARS will not be operated by lineup, movement of track cars' or similar on-track equipment authorities.

6. All mandatory directives will be transmitted and received in compliance with railroad rules and instructions. For purposes of this instruction, all references to assigned crewmembers apply only to the Locomotive Engineer/Pilot.

7. Interlocking machines will be operated manually for the GEOMETRY CAR movement (automatic clearing and routing features will not be used). The control machine operator will be kept informed of the progress of the GEOMETRY CAR from one control point to another. Interlocking control operators will not change the position of any switch or indication of any signal, until informed that the GEOMETRY CAR is clear of the interlocking or a section thereof. Where provided, electrical or mechanical blocking devices will be used on switch and signal controls to protect against opposing and following movements. If the

GEOMETRY CAR is stopped within the limits of any interlocking, the control operator or dispatcher will be notified of the stop and the precise location. The GEOMETRY CAR will not stop within the limits of an automatic interlocking or a non-interlocked, at grade railroad crossing.

8. In automatic block signal system or traffic control system territory, the GEOMETRY CAR should not be stopped on sand or other similar rail surface conditions affecting the shunting of the track circuit. If such a stop cannot be avoided, the GEOMETRY CAR will immediately move a sufficient distance to clear that affected portion of the rail. Track conditions may cause non-shunting. Where provided, electrical or mechanical blocking devices will be used on switch and signal controls to protect against opposing and following movements. However, in all other conditions GEOMETRY CARS have proven reliable and activate track circuits.

9. GEOMETRY CARS will approach all highway-rail grade crossings equipped with automatic warning devices prepared to stop, until it is determined that the warning devices activate and the GEOMETRY CAR occupies the crossing. On-ground protection against highway vehicles will be provided when automatic warning devices fail to fully activate, the GEOMETRY CAR interferes with the normal function, or when prescribed by railroad rules or instructions.

10. GEOMETRY CARS must not exceed the maximum passenger speed and are not restricted by special trackwork. In addition, the maximum operating speed of the FRA T-2000 is 90 mph when self-propelled, and 110 mph when towed by a locomotive. The maximum operating speed of the FRA T-10 is 80 mph in either mode. The GEOMETRY CARS are not equipped with automatic cab signal, automatic train stop, or automatic train control systems and cannot negotiate curves greater than 20-degrees. Additionally, due to truck center length, the center of car swing-out clearance is limited on curves greater than 13-degrees, and may restrict safe movement.

11. The GEOMETRY CAR is equipped with operating controls at either end. When appropriate, instructions will be given to the operator to change and operate from the opposite end. Any reverse movement will be conducted, in accordance with the railroad's operating rules. GEOMETRY CARS are not required to be stopped while being passed by a train on an adjacent track.

12. In the event the GEOMETRY CAR operator is to be relieved for any reason, the Locomotive Engineer/Pilot maybe utilized (if agreeable) to continue operations to the day’s final tie-up point. If the Locomotive Engineer/Pilot is not willing or prohibited from operating the GEOMETRY CAR, the survey should be stopped at a suitable point short of the scheduled tie-up or a locomotive will be requisitioned for tow-in. This contingency is one that will be addressed at the beginning of the survey to allow for ample planning.

13. Neither FRA nor contractor employees will operate a railroad switch or derail and will rely upon a railroad employee to perform that function. After receiving authority for placement from the appropriate railroad representative, protective devices (i.e., signs, derails and locking devices, owned by FRA) will be applied by contractor employees. A ‘blue signal’ will be displayed on or near the GEOMETRY CAR, control stand at a readily visible location and the ‘key’ removed when on ground instrument verification (i-v’s) checks are made. Similarly, positive protection (brakes placed in emergency position and surrendering of the locomotive reverser) will be imposed by FRA when a locomotive tows the GEOMETRY CAR.

14. Except within a locomotive servicing area or car shop area, FRA may reposition the GEOMETRY CAR at anytime on a track or portion of a track that is exclusively occupied by the GEOMETRY CAR and protected by FRA owned devices. Within a locomotive servicing area or car shop area, a 'railroad's blue signal rules' will be in place and complied with to protect 'anyone' on, under or at the ends of the GEOMETRY CAR. The GEOMETRY CAR may be repositioned, only after the movement is authorized by the railroad employee-in-charge of workers and approved by the FRA.

15. When unoccupied and at the request of FRA, GEOMETRY CAR protection will be provided by the railroad. Additionally, the GEOMETRY CAR will not be relocated or coupled to other rolling equipment without permission by the FRA. To prevent undesirable access, a remotely controlled or manually operated switch providing entrance to the track occupied by the GEOMETRY CAR, will be aligned against movement to that track. Where provided, electrical or mechanical blocking devices will be used on the switch and signal controls. Additionally, the switch will be secured with an effective locking device, exclusive to FRA. The switch stand's operating mechanism will be equipped with a visible all-weather display tag warning any users, "Out of Service-Do Not Operate." At the request of the railroad, additional protective measures may be utilized.

    If a switch cannot be aligned and locked, as described, derails capable of restricting access will be used instead of an effective locking device. The placement[1] of front and rear "portable train control" signs will be displayed in the center of the track, marking the presence of the GEOMETRY CAR. The warning sign will consist, of a 16×24-inch red (flag) placard affixed to a derail; signifying rolling equipment cannot couple or pass. A GEOMETRY CAR wheel will be securely chocked to prohibit movement on its own.

[1] Protective devices, owned by FRA, will not be placed less than 150-feet from each end of the GEOMETRY CAR, except where appropriate.